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[Claim(s)]

[Claim 1]A collision form discriminating device which distinguishes a form of a collision of vehicles, comprising:

A deceleration detection means which is arranged ahead [of a cabin of said vehicles / central] and detects deceleration.

A time [to calculate a time integral value of detected this deceleration] integration calculating means.

A collision form determining means which judges a collision form based on a locus to time of a time integral value of calculated this deceleration.

[Claim 2]The collision form discriminating device according to claim 1 which is a means to judge a collision form based on a locus [as opposed to time of time differentiation of a time integral value of said deceleration in said collision form determining means].

[Claim 3]The collision form discriminating device according to claim 2 in which said collision form determining means is a means to judge a collision form to be right ** when a locus to time of time differentiation of a time integral value of said deceleration is a monotone increase.

[Claim 4]The collision form discriminating device according to claim 1 which is a means to judge a collision form to be right ** when a locus to time of a time integral value of said deceleration can approximate said collision form determining means to a secondary curve.

[Claim 5]The collision form discriminating device comprising according to claim 4:

A normalization means which normalizes a locus [as opposed to time of a time integral value of said deceleration in said collision form determining means].

An error arithmetic means which calculates an error of a normalized this locus and a normalized secondary curve.

Right ********** which judges whether a collision form is right ** based on a calculated this

error.

[Claim 6]The collision form discriminating device according to claim 5 in which said error arithmetic means are said normalized locus and a means to calculate a square root of the square sum of a deviation in a prescribed position of a normalized secondary curve as said error.
[Claim 7]The collision form discriminating device according to claim 5 or 6 in which said right ********** is a means a collision form judges that is right ** when said calculated error is below a predetermined value.
[Claim 8]A collision form discriminating method which is a collision form discriminating method which distinguishes a form of a collision of vehicles, calculates a time integral value of deceleration in the central front of a cabin of the (a) aforementioned vehicles, and judges a collision form based on a locus to time of a time integral value of (b) this calculated deceleration.
[Claim 9]The collision form discriminating method according to claim 8 in which said step (b) is a step which judges a collision form to be right ** when a locus to time of time differentiation of a time integral value of said deceleration is a monotone increase.
[Claim 10]The collision form discriminating method according to claim 8 which is a step which judges a collision form to be right ** when a locus to time of a time integral value of said deceleration can approximate said step (b) to a secondary curve.
[Claim 11]Are the collision form discriminating method according to claim 10, and, [said step (b)] (b1) A collision form discriminating method which is a step which normalizes a locus to time of a time integral value of said deceleration, calculates an error of this (b2) normalized locus and a normalized secondary curve, and judges whether a collision form is right ** based on this (b3) calculated error.
[Claim 12]Are the collision form discriminating method according to claim 11, and, [said step (b2)] A collision form discriminating method in which it is said normalized locus and a step which calculates a square root of the square sum of a deviation in a prescribed position of a normalized secondary curve as said error, and said step (b3) is a step a collision form judges that is right ** when said calculated error is below a predetermined value.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the collision form discriminating device and collision form discriminating method which distinguish the form of a collision of vehicles in

detail about a collision form discriminating device and a collision form discriminating method.
[0002]
[Description of the Prior Art]As for occupant crash protection, such as an air bag device carried in vehicles, adjustment of starting timing is performed based on the form of a collision. It is classified into the asymmetric collision (offset collision) with which one side of the front of the symmetrical collision (full lap collision) and vehicles in which the whole front surface of vehicles collides collides as a form of a collision, the oblique collision which collides with angles with arbitrary vehicles, etc. A symmetrical collision is classified into under RAIDO etc. which collide so that it may cave in under the rears, such as right ** with which the whole whole surface of vehicles collides, a pole collision to which the approximately center part of the front of vehicles collides with a subject so that the example which collides with a pole may see, and a track. An asymmetric collision is classified into ORB (Offset Rigid Barrier) which collides with the hard subject not changing, and ODB (Offset Deformable Barrier) which collides with the changing subject.
[0003]
[Problem to be solved by the invention]Since it appears in many cases as a difference of the move direction of the crew member in the case of a collision, movement magnitude, the timing of movement, etc., etc., a difference of the form of a such collision distinguishes the form of a collision, in order to start more suitable occupant crash protection to more exact timing, and it considers using this. As one of the devices which distinguish the form of a collision, the applicant has proposed the device which can distinguish a symmetrical collision and an asymmetric collision effectively based on the decelerating difference and ratio which are detected by G sensor (satellite sensor) arranged at the front right and left of vehicles (Tokuganhei8-326180).
[0004]A collision form discriminating device and a collision form discriminating method of this invention are made into one thing of the purpose for which a collision form of vehicles is distinguished more correctly. A collision form discriminating device and a collision form discriminating method of this invention make it one thing of the purpose distinguished more exactly whether for a collision form of vehicles to be right **. A collision form discriminating device and a collision form discriminating method of this invention are made into one thing of the purpose for which a collision form of vehicles is distinguished more quickly.
[0005]
[The means for solving a technical problem, and its operation and effect] A collision form discriminating device and a collision form discriminating method of this invention took the following means, in order to attain at least a part of above-mentioned purpose.
[0006]A deceleration detection means which a collision form discriminating device of this invention is a collision form discriminating device which distinguishes a form of a collision of

vehicles, is arranged ahead [of a cabin of said vehicles / central], and detects deceleration, Let it be a gist to have a time [to calculate a time integral value of detected this deceleration] integration calculating means, and a collision form determining means which judges a collision form based on a locus to time of a time integral value of this calculated deceleration.

[0007]In a collision form discriminating device of this this invention, a time integral value calculating means calculates a time integral value of deceleration detected by a deceleration detection means arranged ahead [of a cabin of vehicles / central], and a collision form determining means judges a collision form based on a locus to time of a time integral value of this calculated deceleration. Since a locus to time of a decelerating time integral value becomes that which differs by whether it is a collision form, especially right ** of vehicles, it can judge a collision form based on a difference of this locus.

[0008]In a collision form discriminating device of such this invention, said collision form determining means shall be a means to judge a collision form based on a locus to time of time differentiation of a time integral value of said deceleration. A difference of a collision form of vehicles appears in a locus to time of a decelerating time integral value, as mentioned above, but since it appears also in a locus of the rate of change, it can distinguish a collision form based on a locus to time of time differentiation of a decelerating time integral value. In a collision form discriminating device of this invention of this mode, said collision form determining means shall be a means to judge a collision form to be right **, when a locus to time of time differentiation of a time integral value of said deceleration is a monotone increase.

[0009]In a collision form discriminating device of this invention, said collision form determining means shall be a means to judge a collision form to be right **, when a locus to time of a time integral value of said deceleration can resemble a secondary curve. A locus to time of a time integral value of deceleration in right ** of the collision forms of vehicles can be approximated to a secondary curve in many cases, and a secondary curve cannot be resembled with the other collision form in many cases. It is judged using this whether a collision form is right **. No less than two following formulas are contained in a "secondary curve" besides a concept as a curve here.

[0010]In a collision form discriminating device of this invention of a mode distinguished by approximation with this secondary curve, [said collision form determining means] It shall have a normalization means which normalizes a locus to time of a time integral value of said deceleration, an error arithmetic means which calculates an error of this normalized locus and a normalized secondary curve, and right ********** which judges whether a collision form is right ** based on this calculated error. If it carries out like this, a collision form can be distinguished for a grade of approximation with a secondary curve as an objective thing. In a collision form discriminating device of this invention of this mode, said error arithmetic means shall be said normalized locus and a means to calculate a square root of the square sum of a

deviation in a prescribed position of a normalized secondary curve as said error, and. Said right ********** shall be a means to judge with a collision form being right **, when said calculated error is below a predetermined value. If it carries out like this, a collision form can be distinguished quickly more objective.

[0011]A collision form discriminating method of this invention is a collision form discriminating method which distinguishes a form of a collision of vehicles, calculates a time integral value of deceleration in the central front of a cabin of the (a) aforementioned vehicles, and makes it a gist to judge a collision form based on a locus to time of a time integral value of (b) this calculated deceleration.

[0012]In a collision form discriminating method of this this invention, a collision form can be judged by using differing by whether a locus to time of a decelerating time integral value is a collision form, especially right ** of vehicles.

[0013]In a collision form discriminating method of such this invention, said step (b) shall be a step which judges a collision form to be right **, when a locus to time of time differentiation of a time integral value of said deceleration is a monotone increase. Although a difference of a collision form of vehicles appears in a locus to time of a decelerating time integral value, since it appears also in a locus of the rate of change, a collision form can be distinguished based on a locus to time of time differentiation of a decelerating time integral value.

[0014]In a collision form discriminating method of this invention, said step (b) shall be a step which judges a collision form to be right **, when a locus to time of a time integral value of said deceleration can resemble a secondary curve. A locus to time of a time integral value of deceleration in right ** of the collision forms of vehicles can be approximated to a secondary curve in many cases, and a secondary curve cannot be resembled with the other collision form in many cases. It is judged using this whether a collision form is right **. In a collision form discriminating method of this invention of this mode, [said step (b)] (b1) A locus to time of a time integral value of said deceleration shall be normalized, an error of this (b2) normalized locus and a normalized secondary curve shall be calculated, and it shall be a step which judges whether a collision form is right ** based on this (b3) calculated error. If it carries out like this, a collision form can be distinguished for a grade of approximation with a secondary curve as an objective thing. In a collision form discriminating method of this invention of this mode, [said step (b2)] Are a square root of the square sum of a deviation in a prescribed position of said normalized locus and a normalized secondary curve a step calculated as said error, and, [said step (b3)] When said calculated error is below a predetermined value, it shall be a step judged as a collision form being right **.

[0015]

[Mode for carrying out the invention]Next, an embodiment of the invention is described using an embodiment. Drawing 1 is a lineblock diagram showing an outline of composition of the

collision form discriminating device 20 which is one embodiment of this invention using a functional block, Drawing 2 is a lineblock diagram showing an outline of hard structure of the collision form discriminating device 20 of an embodiment, and drawing 3 is an explanatory view which illustrates signs that the collision form discriminating device 20 of an embodiment is carried in the vehicles 10.

[0016]The collision form discriminating device 20 of an embodiment is provided with the following.

The floor sensor 22 which is attached near the central console of the vehicles 10 and detects the deceleration G as shown in drawing 1 and drawing 3.

The integration operation part 28 which inputs the deceleration G detected by the floor sensor 22, and calculates the time integral value VG of the deceleration G.

The collision form discrimination section 30 which distinguishes a collision form based on a locus to lapsed time of the time integral value VG of the deceleration G.

The collision form discrimination section 30 is provided with the following.

The normalizing part 32 which normalizes a locus to lapsed time of the time integral value VG of the deceleration G.

The error operation part 34 which calculates an error of a locus and a secondary curve which were normalized.

The judgment part 36 which judges whether a collision form is right ** based on a calculated error.

[0017]The hard structure of the collision form discriminating device 20 of an embodiment is constituted by the floor sensor 22 and the microcomputer 40 centering on CPU42 as shown in drawing 2. The microcomputer 40 is provided with the following.

ROM44 which memorized the processing program besides CPU42.

RAM46 which memorizes data temporarily.

Input-and-output processing circuit (I/O) 48.

Software and hardware are united and each part of the collision form discriminating device 20 of the embodiment illustrated to drawing 1 functions, when the processing program memorized by ROM44 is started. To drawing 2, in order to judge whether they are other forms, for example, a symmetrical collision, as a collision form of vehicles, or it is an asymmetric collision, the right-and-left front sensors 24 and 26 which are attached, respectively ahead of the side member of the right and left of the vehicles 10 (crash zone), and detect deceleration are also illustrated.

[0018]Next, operation of the collision form determining device 20 of an embodiment constituted in this way is explained. Drawing 4 is a flow chart which shows an example of a right ****** processing routine performed with the microcomputer 40 of the collision form determining

device 20 of an embodiment. This routine is performed when the deceleration G detected by the floor sensor 22 exceeds the predetermined value Gth.

[0019]If a right ****** processing routine is performed, CPU42 of the microcomputer 40 will perform processing which reads first the deceleration G detected by the floor sensor 22 (Step S100). Then, processing which calculates the time integral value VG of the deceleration G which appeared after this routine was started, and read even time as the integration section (Step S102), appears with the calculated time integral value VG, and is written in a predetermined field of RAM46 as the time t and a pair of data is performed (Step S104). And as compared with the threshold Vth (Step S106), the calculated time integral value VG is returned to reading processing of the deceleration G of Step S100, when the time integral value VG is less than the threshold Vth.

[0020]On the other hand, when the deceleration G is more than the threshold Vth, processing which appears with the time integral value VG memorized to the predetermined field of RAM46, reads a pair of data with the time t, and attains normalization is performed (Step S108). Normalization is performed by calculating normalization time t/T by breaking by the threshold Vth to each time integral value VG, calculating normalization time integral value VG/Vth and specifically breaking by the time T when the time integral value VG turned into more than the threshold Vth to the present time t. Drawing 5 is an explanatory view showing an example of the locus to the time t of the time integral value VG, and drawing 6 is an explanatory view showing an example of the locus to normalization time t/T of normalization time integral value VG/Vth corresponding to the locus of drawing 5. Since the time integral value VG and the time t are normalized as shown in drawing 6, the starting point of a locus is the starting point and the terminal point of a locus is set to (1, 1).

[0021]Then, processing which calculates the error E over a secondary curve of a normalized locus is performed (Step S110). An example of the calculation technique of the error E in an embodiment is shown in drawing 7. The curve A is a secondary curve among a figure, and the curve B is the normalized locus. The error E was calculated in the embodiment as a square root (following formula (1)) of the square sum of the deviation e1 of a locus and a secondary curve in time which divides normalization time t/T into four equally as shown in drawing 7 which were normalized, e2, and e3.

[0022]

[Mathematical formula 1]

$$E=\sqrt{e1^2+e2^2+e3^2} \quad \cdots (1)$$

[0023]Here, a Reason for the ability to judge whether a collision form of the vehicles 10 is right ** according to the error E is explained. Drawing 8 is an explanatory view showing an example of a locus to normalization time t/T of normalization time integral value VG/Vth in the case of

right **, Although drawing 9 is a symmetrical collision, it is an explanatory view showing an example of a locus to normalization time t/T of normalization time integral value VG/Vth in the case of collisions of those other than right **, such as a under RAIDO collision which enters into the lower part of a pole collision which collides with a pole etc., or large-sized vehicles. The curve A in drawing 8 and drawing 9 is a secondary curve, the curve C in drawing 8 is the locus by which it was normalized in the case of right **, and the curve D in drawing 9 is the locus by which it was normalized in the case of a symmetrical collision of those other than right **. A locus by which it was normalized in the case of right ** is approximated to a secondary curve so that drawing 8 and drawing 9 may show, but it separates from a locus in the case of a collision of those other than right ** greatly from a secondary curve. Therefore, it can be judged by whether a locus to normalization time t/T of normalization time integral value VG/Vth resembles a secondary curve whether it is right **. In an embodiment, drawing 7 is asked for a grade of this approximation as the error E calculated as a square root of the square sum of a deviation of three loci and a secondary curve so that it may illustrate. That is, the error E can judge with a collision form being right **, when small, and the error E can judge with a collision form being except right **, when large.

[0024]The error E is compared with the threshold Eth if the error E is calculated by returning to the right ****** processing routine of drawing 4 (Step S112), When the error E is below the threshold Eth, a collision form is judged to be right ** (Step S114), and the error E judges a collision form except right **, when larger than the threshold Eth (Step S116), and it ends this routine. The threshold Eth is calculated by experiment etc.

[0025]According to the collision form discriminating device 20 of an embodiment explained above, it can be distinguished with sufficient accuracy whether a collision form is right **. And since it judges only by the operation using the deceleration G detected by the floor sensor 22 attached near the central console of the vehicles 10, a collision form can be distinguished with simple composition. Since a collision form can be distinguished in the early stage of a collision, a distinction result can be effectively used for starting time, starting speed, etc. of occupant crash protection, such as an air bag device.

[0026]Although the error E was calculated in the collision form discriminating device 20 of the embodiment as a square root of the square sum of the three deviations e1 which divide normalization time t/T into four equally, e2, and e3, it may calculate as a square root of the square sum of four or more deviations which carried out 5 or more ****s of normalization time t/T. Since what is necessary is just to search for the grade of approximation with a secondary curve, the correlation value of the locus and secondary curve which were normalized may be calculated, and the error E may be substituted for it. It may calculate as the sum of the absolute value of a deviation, or the square sum of a deviation. Not only a secondary curve but a quadratic expression (an equivalent for a quadratic expression) may be sufficient.

[0027]Although it judged whether a collision form was right ** in the collision form discriminating device 20 of the embodiment according to the grade of approximation with the secondary curve of the locus to normalization time t/T of normalization time integral value VG/Vth, It is good also as what judges whether a collision form is right ** according to the grade of approximation with the secondary curve of the locus to the time t of the time integral value VG which is not normalized. In this case, two following formulas showing a secondary curve will have a coefficient.
[0028]Although it shall judge whether a collision form is right ** in the collision form discriminating device 20 of an embodiment according to the grade of approximation with the secondary curve of the locus to normalization time t/T of normalization time integral value VG/Vth, It is good also as what judges whether a collision form is right ** according to the grade of approximation with the 4th curve or the 2.5th curve, curves, for example, the 3rd curve, other than a secondary curve, etc. As shown in drawing 8, when a collision form is right **, since the time rate of change of the locus to normalization time t/T of normalization time integral value VG/Vth shows the tendency of a monotone increase, it is good also as what judges whether a collision form is right ** based on this time rate of change.
[0029]As mentioned above, as for this invention, although the embodiment of the invention was described using the embodiment, it is needless to say that it can carry out with the form which becomes various within limits which are not limited to such an embodiment at all and do not deviate from the gist of this invention.

[Brief Description of the Drawings]
[Drawing 1]It is a lineblock diagram showing the outline of the composition of the collision form discriminating device 20 which is one embodiment of this invention using a functional block.
[Drawing 2]It is a lineblock diagram showing the outline of the hard structure of the collision form discriminating device 20 of an embodiment.
[Drawing 3]It is an explanatory view which illustrates signs that the collision form discriminating device 20 of the embodiment is carried in the vehicles 10.
[Drawing 4]It is a flow chart which shows an example of the right ****** processing routine performed with the microcomputer 40 of the collision form determining device 20 of an embodiment.
[Drawing 5]It is an explanatory view showing an example of the locus to the time t of the time integral value VG.
[Drawing 6]It is an explanatory view showing an example of the locus to normalization time t/T of normalization time integral value VG/Vth corresponding to the locus of drawing 5.

[Drawing 7]It is an explanatory view showing an example of the calculation technique of the error E.

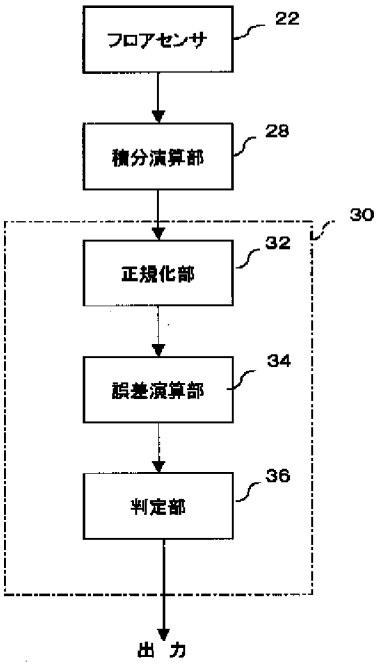
[Drawing 8]It is an explanatory view showing an example of the locus to normalization time t/T of normalization time integral value VG/Vth in the case of right **.

[Drawing 9]It is an explanatory view showing an example of the locus to normalization time t/T of normalization time integral value VG/Vth in the case of the collision of those other than right **.

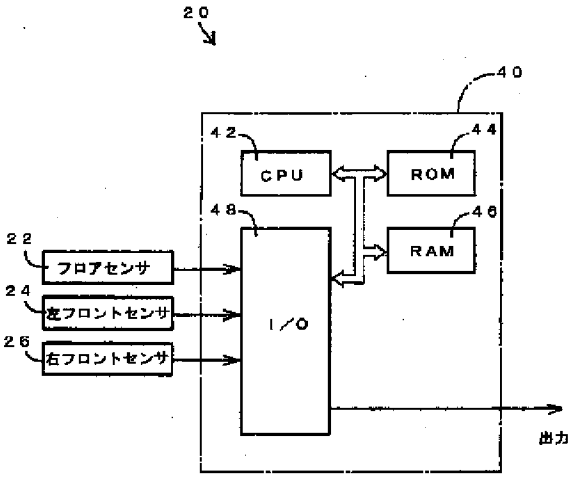
[Explanations of letters or numerals]

10 Vehicles and 20 Collision form discriminating device and 22 Floor sensor and 24 Left front sensor, 26 right front sensor and 28 [An error operation part and 36 / A judgment part and 40 / A microcomputer, 42 CPU, 44 ROM, 46 RAM, and 48 / Input-and-output processing circuit.] An integration operation part and 30 A collision form discrimination section and 32 A normalizing part and 34

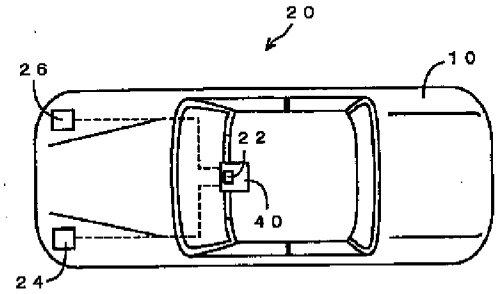
[Drawing 1]



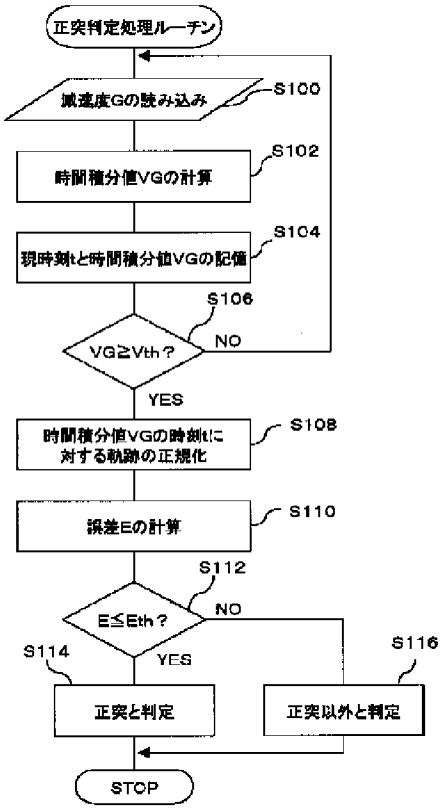
[Drawing 2]



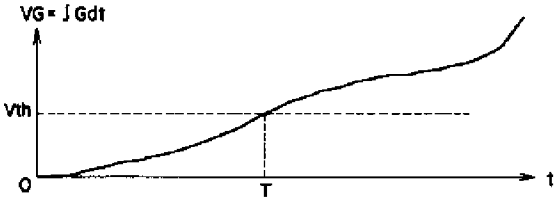
[Drawing 3]



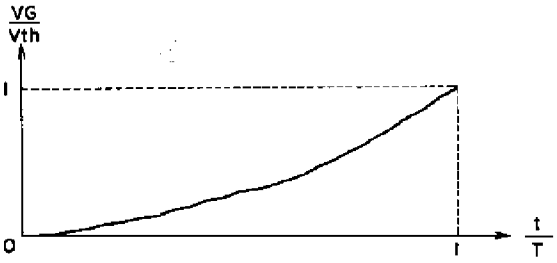
[Drawing 4]



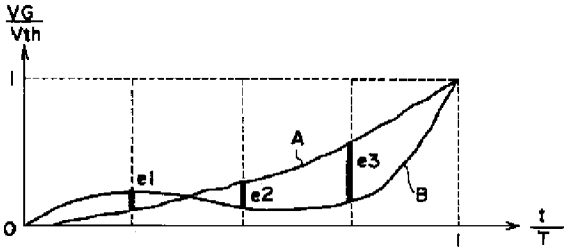
[Drawing 5]



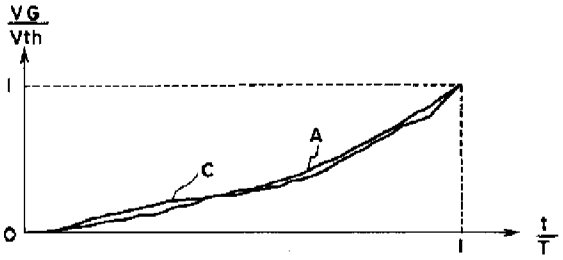
[Drawing 6]



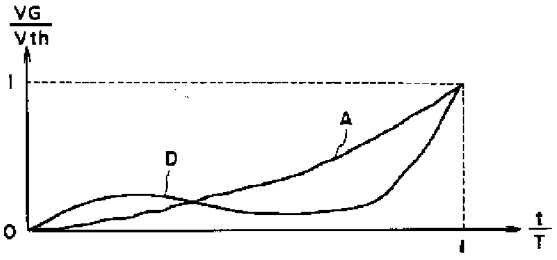
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]